

April 27, 1948.

K. P. SCHENKE
SELF-CLEANING STRAINER

2,440,384

Filed July 20, 1944

2 Sheets-Sheet 1

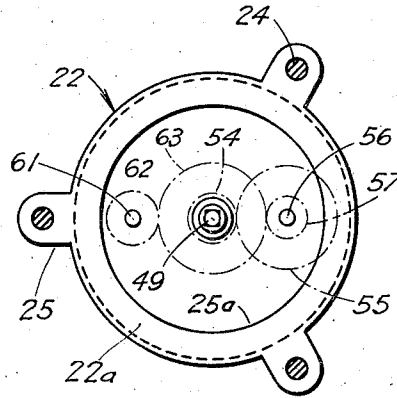
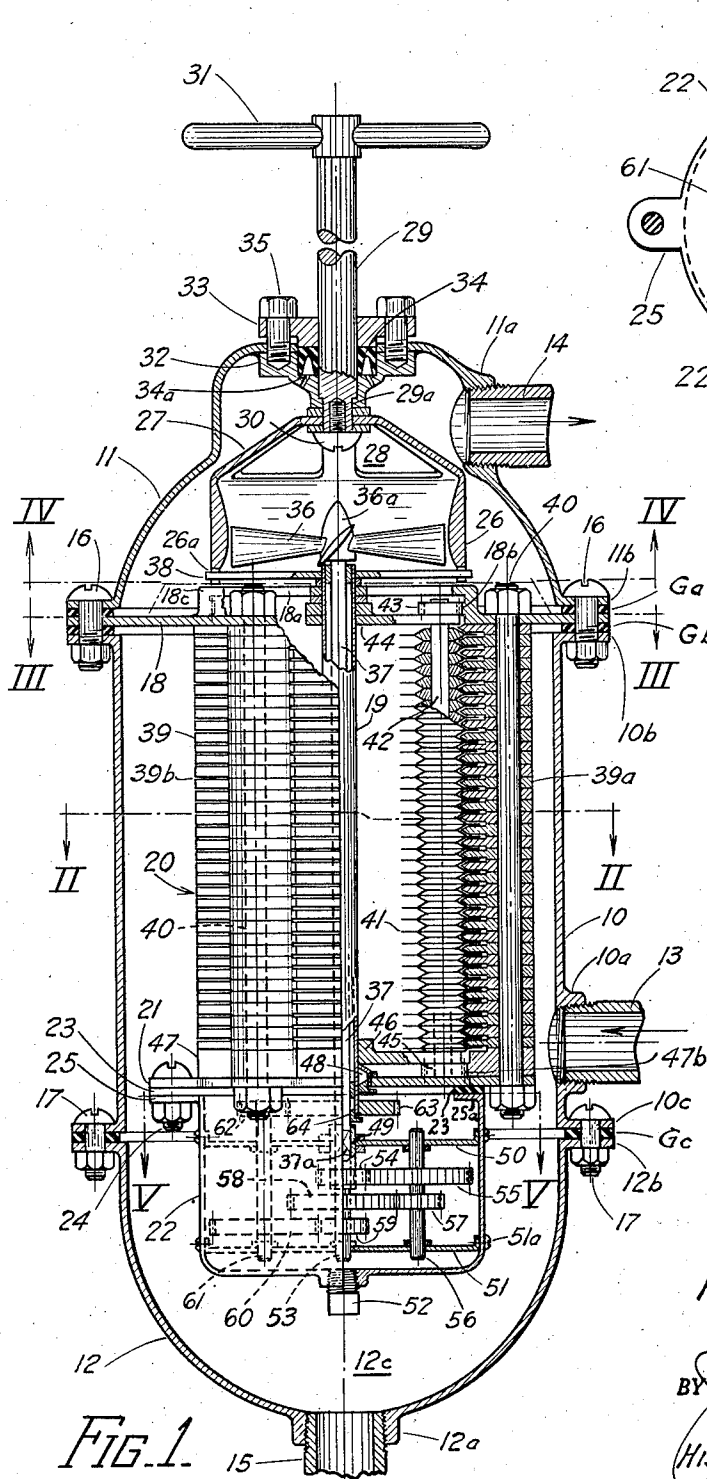


FIG. 5

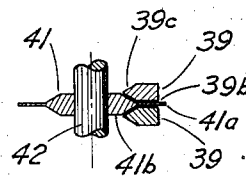


FIG. 6

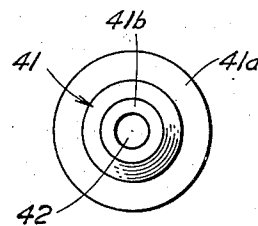


FIG. 7

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2 Sheets-Sheet 2

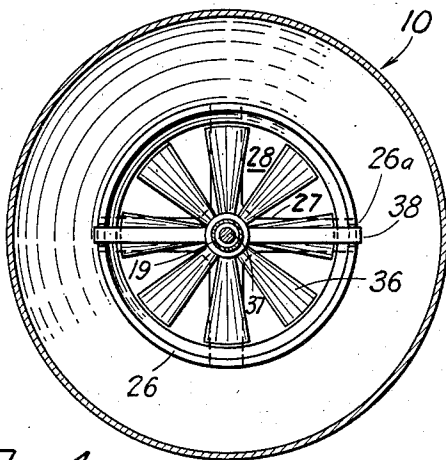


FIG. 4.

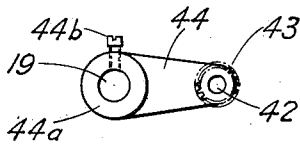


FIG. 9.

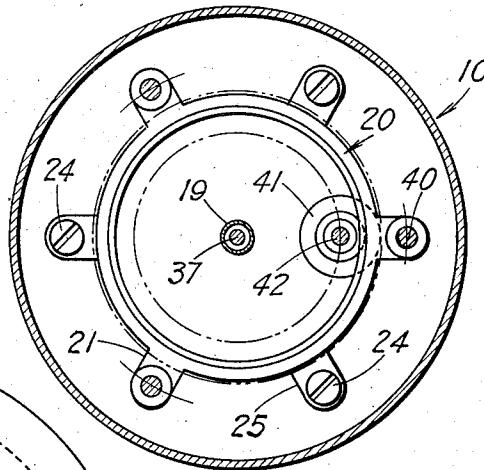


FIG. 2.

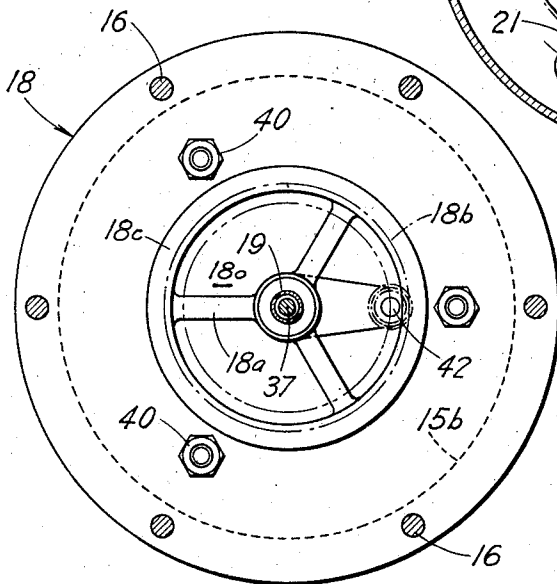


FIG. 3.

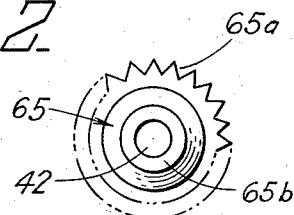


FIG. 10.

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SELF-CLEANING STRAINER

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Application July 20, 1944, Serial No. 545,795

13 Claims. (Cl. 210—167)

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The present invention relates to strainers and more particularly to improvements in self-cleaning strainers of the laminated or annular disc type.

It has heretofore been proposed to construct annular disc type strainers for oil and other fluids in which the flow of the fluid through the strainer automatically actuates a cleaning mechanism by which the screening spaces are cleared and clogging is prevented, or to a great extent is minimized and reduced. Such strainers have also been provided with means for indicating whether or not the cleaning mechanism is functioning. These prior strainers have met with difficulties and have operated unsatisfactorily under many service conditions due to the relative arrangement of the respective parts, lack of an efficient drive mechanism for the cleaning mechanism and in certain cases due to the placement of moving parts within the unscreened fluid flow in which it becomes bound or clogged prematurely.

The present invention is directed to an improved strainer in which the above objections and difficulties have been overcome and eliminated as a result of a novel arrangement of both the fixed and moving parts. The present self-cleaning strainer is provided with a highly efficient turbine impeller arranged to operate within the clean fluid outflow from the strainer within a novel Venturi section. The latter section is mounted upon a spider through which the cleaned fluid flows, the spider being fixed upon a shaft or stem which protrudes through the head of the strainer terminating in a handle which serves both as an indicator of the functioning of the cleaning mechanism and as a means by which the strainer may be rapidly and readily cleaned by an operator. The present arrangement also includes a gear reduction unit within a fluid-tight housing with its own separate lubricating bath, the unit being readily detached from the strainer unit for inspection and servicing.

These and other advantages and objects of the present invention will become apparent to those skilled in the art after reading the present description together with the accompanying drawings forming a part hereof, in which:

Fig. 1 is a cross-sectional view of a preferred form of a self-cleaning strainer embodying the present invention;

Fig. 2 is a sectional plan view taken through the strainer unit along the lines II—II of Fig. 1;

Fig. 3 is a similar sectional plan view taken above the strainer unit along the lines III—III of Fig. 1;

Fig. 4 is a bottom sectional plan view taken through the head section along the lines IV—IV of Fig. 1 showing the Venturi portion and the impeller;

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Fig. 5 is a sectional plan view of the reduction gear housing taken along the lines V—V of Fig. 1;

Fig. 6 is an enlarged vertical sectional view of a cleaner wheel and the adjacent strainer leaves as taken along the lines VI—VI of Fig. 8;

Fig. 7 is a detailed plan view of the cleaning wheel of Fig. 6;

Fig. 8 is a plan view of a leaf section;

Fig. 9 is a detailed plan view of the cleaner wheel arm and pinion; and

Fig. 10 is a detailed plan view of a modified form of cleaner wheel.

Referring now to Fig. 1, it will be seen that the strainer is housed within a central cylindrical casing portion 10 on which is supported a head or cap portion 11 and from which is suspended the base or bottom portion 12. The casing is preferably provided with suitable conventional brackets or legs (not shown) by which it may be suitably supported upon a wall or floor. The section 10 is provided with a tapped connection 10a for the inlet pipe 13, the cap portion 11 being provided with a similar connection 11a for the outlet pipe 14 and the base portion 12 with a similarly threaded connection 12a for the drain pipe 15. The top and bottom of the central section 10 are provided with apertured flanges 10b and 10c matching respectively the lower flange 11b of the top section and the upper flange 12b of the lower section. The flanges are attached by the sets of through-bolts 16 and 17 and are made tight against the ring gaskets Ga, Gb and Gc of rubber or other composition resistant to the fluid for which the strainer is intended.

By reference to Figs. 1 and 3 it will be noted that a supporting disc or plate 18, having a central opening 18o and peripheral apertures for the flange bolts, is interposed between the flanges 10b and 11b, and the gaskets Ga and Gb, being clamped therebetween by the bolts 16. The disc 18 has a central three-arm spider 18a the hub of which forms a journal for the vertically disposed quill-shaft 19. This disc 18 forms the support from which the strainer disc stack or unit 20, its bottom plate 21 and the reduction gear unit 22 are suspended in a centralized position within the casing sufficiently above the bottom to provide a sump space 12c. The opening 18o is defined by an upstanding offset flange or rim 18c of Z-shape cross-section forming an exit aperture from the interior of the strainer unit 20, the partitioning plate 18 preventing the flow of unstrained fluid from passing directly into the cap portion. The upper edge of the gear housing 22 is provided with an internally extending flange 25a and external apertured lugs 25 attached to the lower plate 21 by the through-bolts 24 clamping the gasket 23 therebetween.

An annular venturi 25 is centrally suspended from the cap portion 11 clear of and closely spaced

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above the rim 18c of the support disc 18. This venturi has a spider portion 27 apertured at 28 and is attached to the lower squared end 29a of the stem 29 by the attachment screw 30. The stem 29 has fixed to its upper terminal a T-handle 31 and where it passes through the cap 11 it is made fluid-tight by the stem guide fitting 32 suitably recessed and provided with an annular internal space adapted to closely receive the plastic seal or packing ring 34, retained by the cap fitting 33 held in place by the screws 35. The seal 34 has a generally U-shaped cross-section, being of a pliable plastic having chemically resistant properties and is made fluid-tight as a result of fluid pressure exerted through the drilled bleeder or vent hole 34a. The seal may be of rubber or similar synthetic composition resistant to hydrocarbon oils, acids, alkalies and other chemicals present in the fluid and automatically increases its sealing qualities with the increase in pressures applied through the bleeder holes 34a.

The turbine impeller blades 36 are mounted upon the streamlined hub 36a which is fixedly attached to the upper terminal of the driven shaft 37 which in turn is co-axially mounted for rotation within the quill-shaft 19. To the upper terminal of the quill-shaft 19 there is fixedly attached a cross-arm 38 which fits within the notches or detents 26a in the lower rim of the venturi 26, serving as a coupling means, and causes the latter, and its attached parts including the stem 29 and handle 31, to rotate slowly therewith.

The strainer stack or unit is composed of a plurality of super imposed discs 39 of generally annular form having three projecting lugs 39a apertured to receive the threaded rods and nuts 40. The inner edge of each leaf is tapered or wedge-shaped as at 39c to closely clear the hubs 41b of the cleaner wheels 41, and the lugs 39a are provided on both sides with an annular boss of slightly greater thickness to create the screening space 39b within which the cleaner-wheel edges 41a are adapted to rotate and project as more clearly shown in Fig. 6. A radial arm 44 is attached to the quill-shaft 19 within the opening 18a and substantially in the plane of the upper disc 18 and a similar arm 46 is attached to the lower end of the quill-shaft adjacent the lower disc or bottom plate 21. The hubs of the cleaner-wheels 41 are each fixedly attached to a vertically disposed shaft 42 journaled within the outer terminals of the upper and lower radial arms 44 and 46 respectively, each of which are fixedly mounted upon the quill-shaft 19, as by the set screws 44b passing through the hub 44a in Fig. 9. An annular ring 47 of substantially the same plan form as the discs 39, but appreciably greater in thickness, is disposed between the lowest disc and the bottom plate 21. This ring 47 is recessed at its upper face to receive the lowest cleaner wheel 41 and is internally provided with a series of teeth forming a ring gear 47b engaged by the pinion 45.

Above and below the arms 44 and 46 there are fixedly mounted upon the terminals of the shaft 42 the pinions 43 and 45 which engage respectively the internal gear teeth 18b and 47b of the upper support plate 18 and the lower ring element 47. The quill-shaft 19 extends downwardly through the stuffing-box 48 in the bottom plate 21, preventing the fluid under pressure within the strainer unit 20 from entering the reduction gear box 22. The lower end of the impeller shaft 37 also extends past the bottom plate

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21 in a fluid-tight manner terminating in a squared end 37a adapted to engage the similarly squared coupling 49 of the reduction gear unit.

This reduction unit 22 is provided with horizontally disposed bearing discs 50 and 51 attached to the casing walls as by the screws 51a and within which the vertically disposed shafts 53, 55 and 61 are journaled. The bottom of the reduction gear housing 22 is provided with a centrally disposed drain plug at 52 and the central or first shaft 53 directly thereabove is rotatably journaled within the aforementioned tubular squared coupling 49. A first pinion 54 is fixedly mounted upon the outside of the coupling tube or sleeve 49 and meshingly engages a first gear 55 fixed upon the second shaft 56. The coupling 49 serves to transmit rotative torque from the drive shaft 37 to the driving pinion and permits the gear box unit to be readily engaged or disengaged from the impeller shaft 37 and the quill-shaft 19 simultaneously with disengagement of the gear 63 and pinion 62 together with attachment or removal of the bolts 24. A second pinion 57 is also fixed on the latter and engages with a second gear 58 fixed upon the central shaft 53. A third pinion 59 is fixed upon the central shaft and engages the third gear 60 on the third shaft 61 upon the upper end of which there is fixed a fourth pinion 62 disposed on its upper terminal above the upper disc 50. The last said, or low speed pinion 62 meshes with the gear 63 fixedly mounted upon the lower terminal of the quill-shaft 19 which is internally made fluid-tight against the impeller shaft 37 by means of the adjacent stuffing-box 64.

The operation of the present self-cleaning strainer is as follows:

Oil or other fluid under pressure enters through the inlet 13 and fills the interior of the casing portions 10 and 12 externally of the strainer unit 20, and the gearing unit 22. It is then forced through the annular orifices or spaces 39b between the adjacent strainer discs 39. This spacing is preferably closely controlled and designed for the service under which the device is to operate and should be of such dimension that dirt, gum, tars, foreign matter and the like are strained out or prevented from passing through these horizontal spaces. As the fluid passes through these spaces it is strained and cleaned of objectionable contaminants and fills the cylindrical interior of the unit 20, and being prevented from passing downwardly by the lower plate 21 and its stuffing box 48, it is forced upwardly through the throat of the venturi 26, the openings 28 in the spider 27 and thence through the outlet 14.

In passing through the throat of the venturi in the plane of the impeller disc 36 the rate of flow is considerably increased and rotation is imparted to the blades of the impeller. The force which is thus imparted to the impeller and its shaft 37 is one of relatively low torque and high speed. The shaft 37 through its engagement with the squared coupling tube at 49 imparts like rotation to the pinion 54 and the reduction gear train 55, 57—58, 59—60, and 62—63, and their shafts 56, 53 and 61. Due to the reduction in rotative speed the force imparted to the quill-shaft 19 by its attached gear 63 is now one of relatively high torque and low speed. As the quill-shaft 19 thus is rotated slowly, and at a speed which is substantially proportional to the rate of fluid flow through the strainer, it carries with it the cross-arms 38 and the cleaner wheel arms 44 and 46. Rotation of the cross arms

38 causes like rotation of the venturi 26 with its notches 26a and the attached stem and handle 29—31.

This rotation of the handle is accordingly an indicator that the fluid flow is actuating the cleaner wheel arms 44 and 45. In the event however that it is known that fluid is being fed under pressure into the inlet 13 without imparting rotation to the handle it is an indication that the strainer spaces are either entirely clogged or that they have become clogged to such an extent that the impeded flow through the strainer is reduced beyond the rate at which rotation is being imparted to the impeller 35.

Rotation of the cleaner wheel arms 44 and 45 carrying the pinions 43 and 45 imparts rotation to the shaft 42 and also to the stack of superimposed cleaner wheels 41. The thin edges 41a of the wheels advance within their horizontal planes as the shaft 42 rotates about the axis of the strainer and about its own axis in an opposite direction, the edges serving to push back accumulated foreign matter toward the outside periphery of the leaf stack from where it falls downwardly past the gear box 22 into the sump 12c. The wheels 41 rotate about the axis of the shaft 42 which revolves in a direction opposite to that of the central shaft 37 and also revolve around the inside of the strainer unit 20 about the central axis of shaft 37 and in the same direction as said shaft. In actual practice it is preferable that an operator observe the handle of each strainer at regular intervals and manually rotate those which may have stopped until they each again become self-rotating. At lesser—but also at regular—periods he should open the drain line 15 to draw off or blow down the accumulated sediment, sludge or the like which will gather in the sump 12c.

The lower terminals of the impeller shaft 37 and the quill-shaft 19 are each arranged to automatically become engaged with the corresponding drive elements of the reduction gear unit as the holes in the lugs 25 of the latter are brought into registration with the holes in the lugs 21 for the bolts 24. The squared aperture in the tubular coupling 49 slips over and engages the correspondingly squared end of the lower terminal of the impeller shaft 37 as the pinion 62 comes into meshing engagement with the low speed quill-shaft gear 63.

In the straining of fluids containing tacky or gummy matter a cleaner wheel of a form like that shown in Fig. 10 has been found very satisfactory. This cleaner wheel 65 has a similar outwardly tapering hub 65b suitably apertured for the shaft 42 and provided with serrated or saw-tooth edges 65a. These teeth as they both roll and rotate through the leaf gaps, cut and tear loose any gummy or tacky matter which adheres to or forms a film on the exterior circumference of the discs. Under more severe operating conditions it has been found advantageous to increase the tip speed of the cleaner wheels by either having the pinions 43 and 45 rotate on the outside of the fixed ring gear 18b or by providing a train of gears to step up the wheel shaft speed. This arrangement also has the advantage that the wheel rotation is clockwise such that the outer or cutting periphery advances against the accumulated film as the cleaner-wheel assembly also moves in the same or clockwise direction.

It will accordingly be seen that a self-cleaning and self-wiping laminated strainer is thereby

provided in which a novel disposition of the movable and fixed parts contributes to a fool-proof and highly efficient strainer. The impeller and its shaft as well as the quill-shaft and cleaner wheel stack each operate in clean oil. The dirty fluid comes into contact only with the interior of the central and lower casing sections and the exterior of the leaves and reduction gear housing. The only movable parts the dirty fluid comes into contact with are the cleaning edges of the cleaner wheels as they rotate about their own and the axis of the strainer.

The reduction gear housing operates in its own lubricating oil bath and is readily accessible for servicing or replacement upon removal of the sump section 12. The impeller and venturi are similarly made readily accessible by the removal of the cover section 11 after which the remainder of the unit comprising the strainer stack, cleaner assembly and reduction gear unit can be removed by merely lifting out the supporting plate 18. By removal of all of the movable parts and plugging the seals 34 and 48 the strainer can be used as an efficient and serviceable fixed unit.

Other forms and modifications of the disclosed strainer, both in respect to its general arrangement and the details of its several parts, which will occur to those skilled in the art after reading the present description are intended to come within the scope and spirit of the present invention as more particularly defined in the appended claims.

I claim:

1. A fluid strainer comprising a main casing portion having a fluid inlet through the wall thereof, a casing portion having a fluid outlet, a supporting element having an opening disposed between said main and said outlet casing portions to form a partition to seal off said main portion from said outlet portion, a strainer unit having vertically spaced laminations supported by said supporting element in an inwardly spaced relationship from the wall of said main casing portion, said strainer unit having an outlet open to the opening in said supporting element, rotatable means disposed within said strainer unit adapted to extend between and clean the spaces between said laminations, an axial flow impeller disposed at said opening in said supporting element operatively connected to said rotatable cleaning means adapted to be driven by the fluid flowing from the outlet side of said strainer unit for the automatic cleaning of said spaces.

2. A strainer for a fluid comprising a main casing portion having a fluid inlet, a cap casing portion attached to said main portion, said cap casing portion having a fluid outlet, a centrally apertured partition element disposed between said cap and main casing portions such that the fluid is directed to flow from said inlet through said aperture toward said outlet, an annular disc strainer unit suspended from said partitioning element having peripheral straining spaces exposed to said inflowing fluid and with its outlet coinciding with the aperture in said partitioning element, cleaning means rotatably mounted within said strainer unit adapted upon rotation to clean said peripheral straining spaces, a Venturi element supported by said cap portion open to and adjacent the said aperture in said partitioning element, impeller means rotatably supported within said Venturi element, driving means operatively interconnecting said impeller means with said cleaning means arranged such that said impeller means is adapted to rotatably drive said

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cleaning means by the flow of fluid passing from within said unit through said partitioning element aperture, said adjacent Venturi element and the impeller means rotatably mounted therein.

3. A fluid strainer comprising a main casing portion having a fluid inlet, a cap casing portion attached to said main portion having a fluid outlet, a centrally apertured partitioning element disposed between said cap and main casing portions such that the fluid flow is directed from said inlet through said aperture toward said outlet, an annular disc strainer unit suspended from said partitioning element within said main casing portion having peripheral straining spaces exposed to said inflowing fluid and with an outlet coinciding with the aperture in said partitioning element, cleaning means rotatably mounted within said strainer unit adapted upon rotation to clean said peripheral spaces, a venturi disposed on the outlet side of the aperture in said partitioning element, arm means rotatably mounted within the fluid in the interior of said strainer unit radially extending from the axis thereof, impeller means rotatably mounted within said venturi and the fluid flow passing through the aperture of said partitioning element, and driving means interconnecting said cleaning, radial arm and impeller means such that the said impeller means is adapted to actuate said cleaning and radial arm means for cleaning said straining spaces.

4. A self-cleaning fluid strainer comprising a main casing portion having a fluid inlet, a cap portion having a fluid outlet, a centrally apertured partitioning element disposed intermediate said main and cap portions, an annular disc strainer unit suspended within said main casing portion having circumferential straining spaces exposed to an inflowing fluid, a venturi supported within said cap portion open to said aperture in said partitioning element, cleaning means rotatably mounted within the interior of said strainer unit extending between said straining spaces, impeller means rotatably mounted within said venturi for rotational operation by the accelerated axial fluid flow therethrough, and operating mechanism connecting said impeller means with said cleaning means adapted to actuate said cleaning means for clearing said straining spaces.

5. The combination with a self-cleaning strainer having a main casing portion with a fluid inlet, a cap casing portion having a fluid outlet, an apertured partition element supported between said main and cap casing portions, an annular disc strainer unit suspended from said partition element within said main casing portion having an outlet open to the aperture in said partition element, cleaning means operatively associated with said strainer unit, an impeller rotatively supported on the outlet side of said strainer unit arranged for driving said cleaning means by the fluid outflow from said strainer unit through said apertured partition element, and operating means connecting said impeller with said cleaning means, of a Venturi element having a throat portion disposed contiguous to the aperture in said partition element encircling said impeller at its throat portion for guiding and augmenting the speed of the said outflowing fluid.

6. The combination with a self-cleaning strainer having a main casing portion with a fluid inlet, a cap casing portion having a fluid outlet, an apertured partition element transversely supported from said casing portions, a strainer unit suspended from said partition element within said main casing portion having an outlet open to the

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aperture in said partition element, cleaning means operatively associated with said strainer unit, an impeller rotatively mounted at the aperture of said partition element arranged for driving said cleaning means by the fluid outflow from said strainer unit through said aperture in said partition element and mechanism operatively interconnecting said impeller with said cleaning means, of a Venturi element co-axially disposed with respect to said partition aperture and in surrounding relationship with said impeller whereby the flow of said fluid is guided toward said impeller and its speed augmented therethrough.

7. The combination set forth in claim 6 characterized by the inclusion with said strainer of a reduction gear train operatively interconnecting said impeller with said cleaning means adapted to convert the high-speed low-torque of the former into the low-speed high-torque actuation of the cleaning means.

8. The combination set forth in claim 6, characterized by the inclusion with said strainer of a reduction gear train operatively interconnecting said impeller with said cleaning means arranged for the low speed actuation of said cleaning means, and a fluid-tight housing suspended from said strainer unit completely enclosing said reduction gear train, said housing filled with lubricant providing a lubricant bath for said reduction gear separated from the fluid passing through said strainer, said reduction gear train arranged to convert the high-speed low-torque of said impeller into low-speed high-torque actuation of said cleaning means.

9. The combination set forth in claim 6, characterized by the inclusion with the described strainer of a stem attached to said venturi passing through an opening in said cap portion, a journal formed by the opening in said cap portion for the rotatable mounting of said venturi and attached stem therein, coupling means directly connecting said stem-attached venturi with said cleaning means, and manual means attached to an exterior portion of said stem adapted to serve both as an indicator of the self-operation of said cleaning means by the fluid flow through said impeller and as a means for the direct manual actuation of said cleaning means by the manual rotation of said stem, venturi and coupling means.

10. In a self-cleaning fluid strainer of the annular disc type including a casing having an inlet and an outlet, apertured supporting means extending across said casing intermediate said inlet and outlet, a strainer unit supported from said supporting means disposed on the inlet side thereof, the said strainer unit having an outlet open to the aperture in said supporting means, and cleaning means for said strainer unit movably mounted therein, the combination of a fluid impeller operatively connected to said cleaning means disposed on the outlet side of said apertured supporting means and a venturi co-axially disposed about said impeller for augmenting the rate of fluid flow therethrough.

11. A self-cleaning strainer of the type set forth in claim 10 characterized by said cleaning means comprising a plurality of serrated wheels rotatable by said impeller for the cleaning of said annular discs.

12. A self-cleaning strainer of the type set forth in claim 10 characterized by a reduction gear mechanism operatively connecting said impeller with said cleaning means and a fluid-tight housing for said mechanism for retaining a lubricant for said mechanism separate from said fluid.

13. In a strainer apparatus, a casing having an inlet and an outlet, a strainer unit supported within said casing, driving mechanism for the automatic and manual cleaning of said strainer unit, said strainer unit having an axial outlet, said mechanism including a driving high speed shaft journaled for rotation within the strainer unit, an axial flow impeller attached to said shaft disposed at said strainer unit outlet, an annular Venturi element journaled for rotation co-axially about said impeller, a handle attached to said venturi arranged for its manual rotation, a driven hollow quill-shaft co-axially journaled for rotation about said high speed shaft, reduction gearing operatively connecting said driving and driven shafts, cleaning means attached to said driven shaft operatively connected to said driving mechanism for cleaning the strainer unit and coupling means operatively interconnecting said venturi and driven shaft whereby manual rotation of said handle directly drives said cleaning mechanism through said venturi, coupling means and driven

shaft, and said mechanism is automatically operated by axial flow rotating said impeller, driving shaft and said driven shaft through said reduction gearing.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,741,444	Slider et al.	Dec. 31, 1929
1,754,728	Thompson	Apr. 15, 1930
1,757,153	Thompson	May 6, 1930
1,852,873	Berger	Apr. 5, 1932
1,987,597	Cuno et al.	Jan. 15, 1935

FOREIGN PATENTS

Number	Country	Date
215,550	Germany	July 12, 1908